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(54) Abstract Title
Displaying "wallpaper" on a mobile telephone display

(57) A mobile phone with a display screen capable of displaying a main display "on top" of a background or wallpaper display is provided. A display compiler combines the main display with the background display such that the main display appears on top of the background. The background can be updated at regular intervals so that it can be animated. A method for compiling the composite display is also provided. The main display and background displays are combined using an OR function. Furthermore, the contrast of the foreground can be set to a value higher than that of the background image.

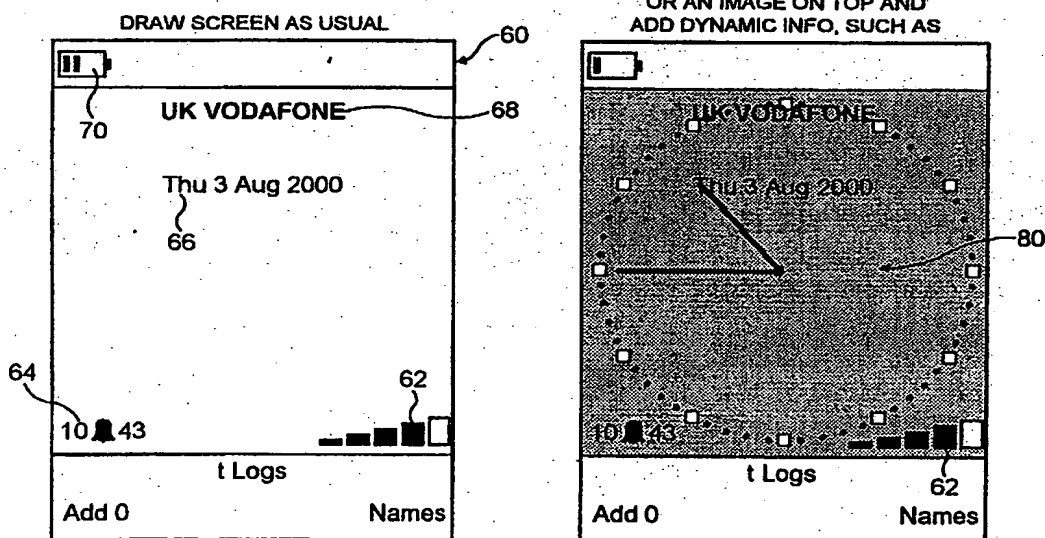


FIG. 5

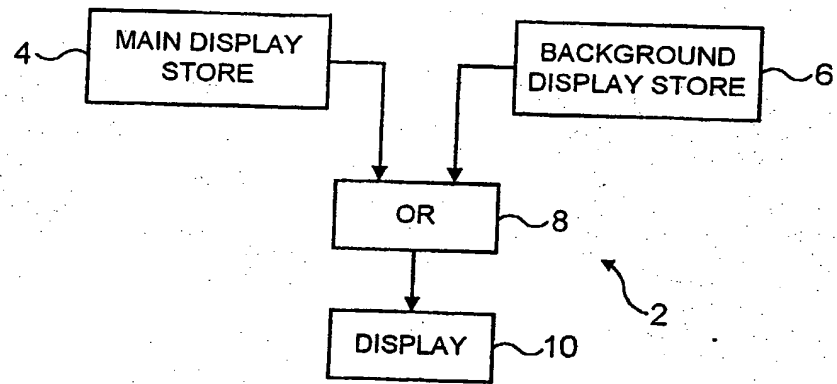


FIG. 1

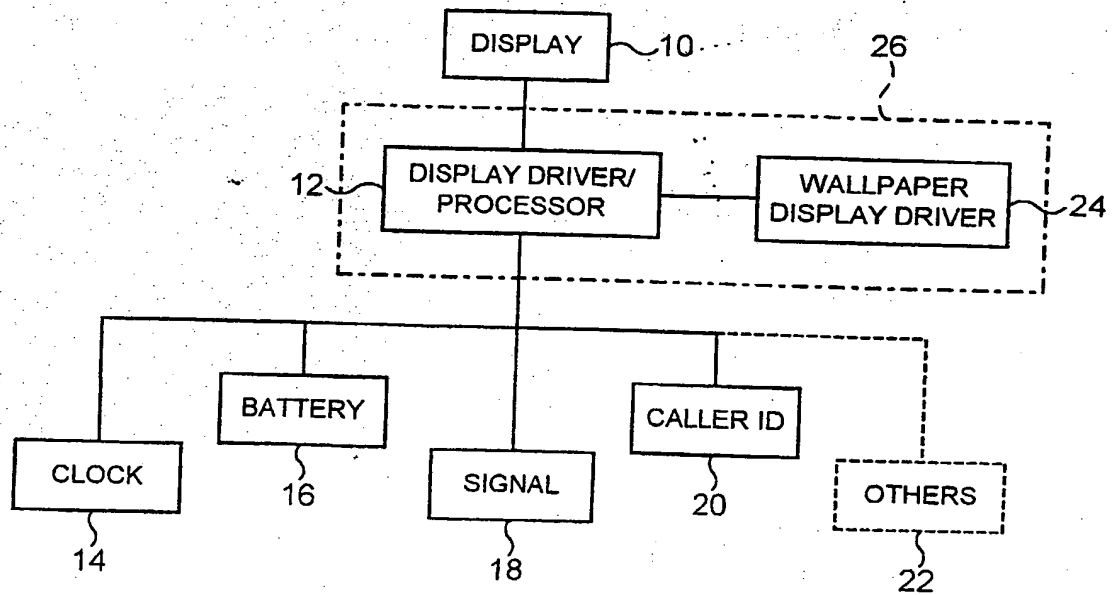


FIG. 2

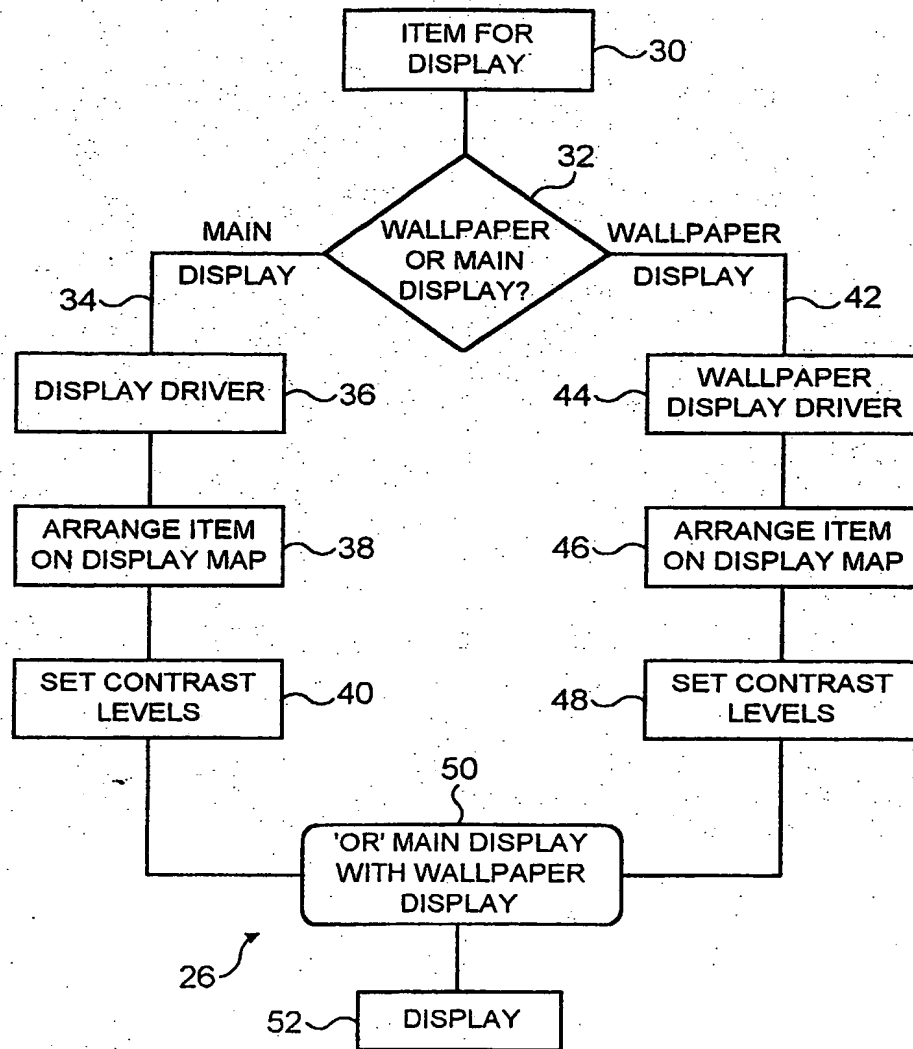


FIG. 3

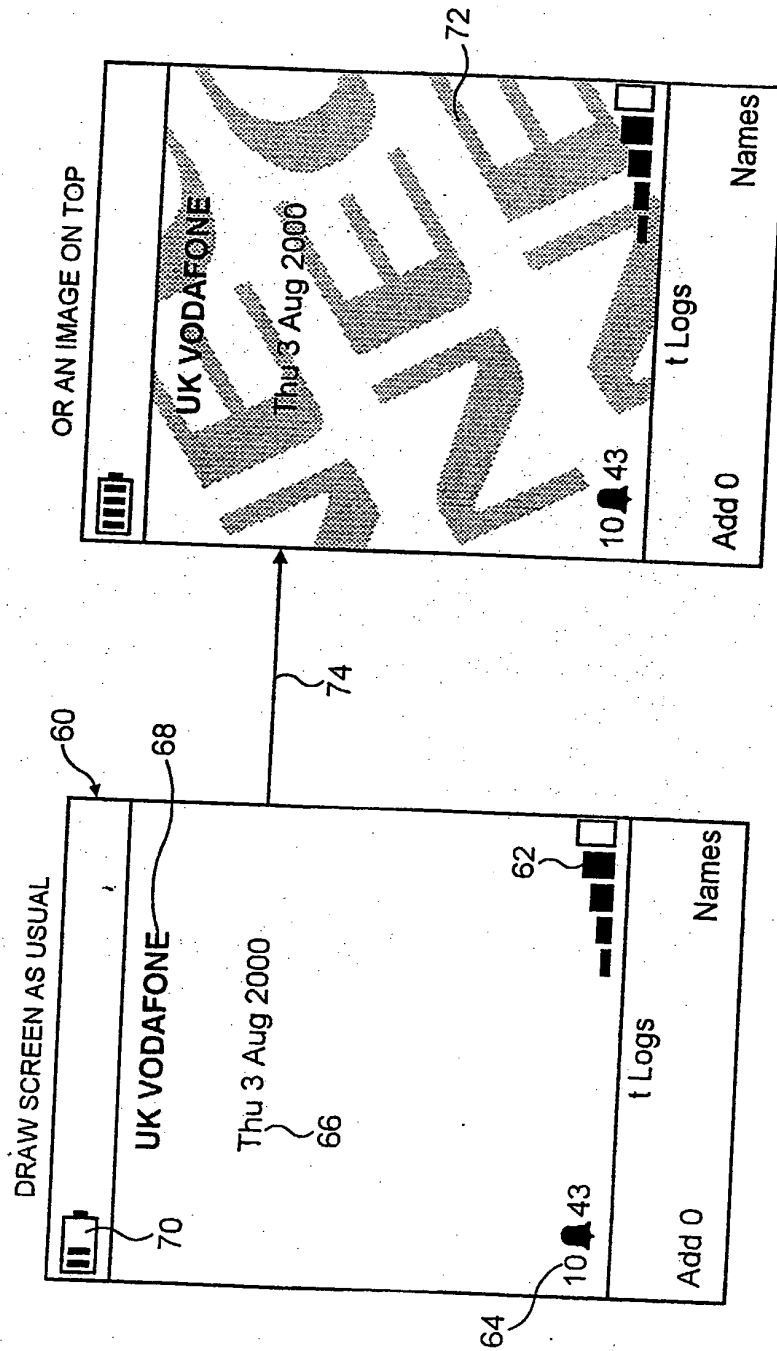


FIG. 4

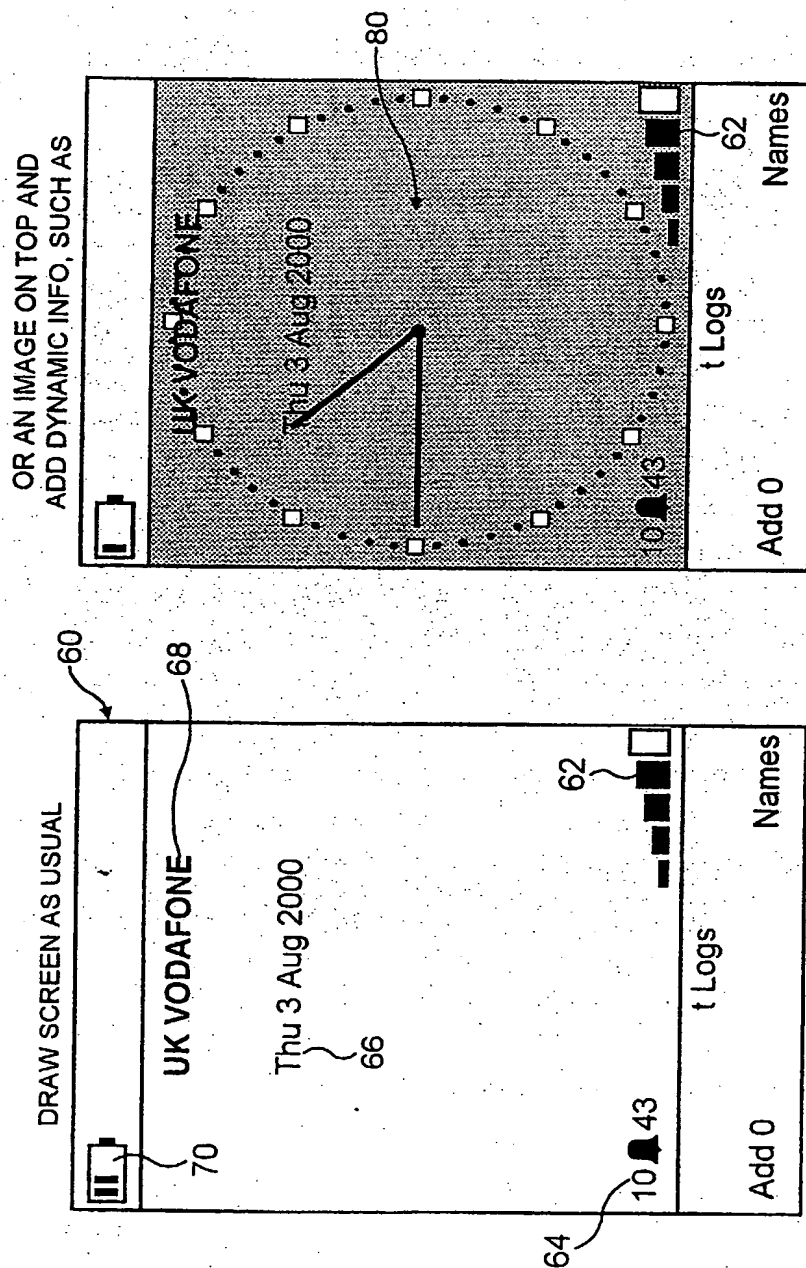


FIG. 5

MOBILE TELEPHONE DISPLAY**FIELD OF THE INVENTION**

This invention relates to mobile telephones, and in particular, to improvements to mobile telephone display units.

BACKGROUND OF THE INVENTION

Presently, mobile telephone displays are used to display pertinent information to the user. This may include information regarding the charge remaining on the battery or the number and name of the person calling the mobile phone's number. The display can also be used to display text messages or simple computer games.

Such displays generally use liquid crystal technology (LCD) well known in the field. They are bitmap display screens with a number of LCD pixels arranged in a grid on the display making up the display area. Shapes, letters and numbers can be displayed by activating pixels in a predetermined way such that areas of dark or light appear against a contrasting plain background.

The dimensions of the screens are limited by the size of the telephone, and presently a typical screen measures roughly 3 cm by 4 cm. The space for displaying information to the user is limited by the screen size and the legibility of the display.

SUMMARY OF THE INVENTION

We have appreciated that existing displays within mobile telephones are limited in the information that can be presented at any one time. With the problem of providing as large a display as possible within the confines of a telephone we have appreciated that improvements to mobile telephone displays can be made.

Accordingly, the present invention provides a mobile telephone display unit for displaying information to a user, comprising; a first memory store for storing a main image; a second memory store for storing a background image; a combiner for combining the main image with the background image thereby forming a composite image; and a display for displaying the composite image.

The present invention further provides a mobile telephone comprising a mobile telephone display unit according to the present invention.

The present invention also provides a method for displaying a background image on a mobile telephone display screen, the method comprising; compiling a main display with a contrast level; compiling a background display with a different contrast level; combining the main display and the background display thereby forming a composite display.

BRIEF DESCRIPTION OF THE FIGURES

The present invention will now be described by way of example and with reference to the accompanying drawings, in which;

Figure 1 is a schematic of an apparatus embodying the present invention;

Figure 2 is a block diagram of a display unit architecture embodying the present invention;

Figure 3 is flow diagram showing the processes of a method embodying the present invention;

Figure 4 shows a display with and without wallpaper display embodying an aspect of the present invention (Vodafone and NEC are registered trade marks);

Figure 5 shows a display with and without wallpaper display embodying another aspect of the present invention.

DESCRIPTION OF EMBODIMENTS OF THE PRESENT INVENTION

Referring to figure 1, a display unit 2 embodying the invention is shown. A memory store 4 for the main display and a memory store 6 for the background display are provided. The memory stores 4, 6 may standard random access memory (RAM) chips available on the market and can comprise separate logical areas of a single physical store. A combiner 8 comprises an OR gate and combines the data from the main image store 4 with the data from the background image store 6. The resulting composite image is displayed on a display screen 10.

Referring to figure 2, the display screen 10 of a mobile phone is driven by a display driver or processor 12. The driver 12 obtains information to be displayed on the screen 10 from an appropriate hardware or hardware controller. This information can be stored in the main display memory (not shown). Such information may include the time, remaining battery life, the mobile phone network signal strength, the name or number of the caller calling the phone and other such information. This information can be obtained from the clock 14, the battery control circuit 16, the signal receiver 18, the incoming call control circuit 20 and other hardware 22 available to the telephone. The information may also be transmitted to the mobile telephone.

In a preferred embodiment of the present invention a background display driver 24 is shown as an adjunct to the display driver 10. The background driver 24 processes the image to be displayed as a wallpaper or background on the screen 10. This information can be stored in the background driver memory (not shown). A wallpaper or background image is one that appears to the user as a background to the main display. It is often referred to as a wallpaper image since it can comprise a repeated pattern and appears similar to conventional wallpaper used as decor.

The background image display driver 24 and the display processor 12 combine to form a display combiner 26.

Referring to figure 3, an item 30 to be displayed is questioned by the display compiler 26 at step 32. This determines whether the item is intended to be displayed as a main display item or background display item. The criteria used for determining the status of the item for display as main display or background may be preset by the user of the telephone. If the item 30 is for display as a main item, that is an item to be displayed on top of the background, the item 30 is directed on path 34 to the display driver 36 and main display memory (not shown). Step 38 arranges the item to be displayed in the correct position on the display map and in the correct format on the screen. The contrast levels of the display are set by step 40.

If the item 30 is to be displayed as background, that is displayed behind the main display items, it is directed on path 42 to background display driver 44 and background display memory. Step 46 arranges the background image to be displayed in the correct format and the position on the display map. A relatively small image can be repeated to form a patterned background or wallpaper to the display, such as a chequer board or similar repeating pattern. The contrast levels of the background display are set by set 48.

The contrast levels, or bit depth, for each of the main and background displays are set so that main display has a higher contrast than the background display. For example, in the preferred embodiment the LCD has four grey scale contrast range ranging from white or clear, through light grey, dark grey, to black. This provides a maximum bit depth of 4. Each level in the grey scale is assigned a number, for example, 0 for white, 1 for light grey, 2 for dark grey and 3 for black. In the preferred embodiment of the invention the main display pixels are assigned a contrast level of either 0 or 3, that is the highest contrast level available on the display. The background display pixels are set with

contrast levels of either 0, 1 or 2; the contrast of the wallpaper display is less than the main display.

At step 50 the main display pixels and the wallpaper display pixels are combined to form a composite display consisting of the main display appearing on top off the background. In a preferred embodiment each of the main and background displays are bitmap images corresponding to the pixel grid of the screen. Each pixel of the main display is combined is with the corresponding background display's pixel. The combination is achieved using an OR function on each of the display's pixels.

In the preferred embodiment a main display pixel will have a value of 0 or 3. If the combination function determines that the pixel has a grey scale level value of 3 then that pixel will be displayed in preference to any other pixel and at the strongest level of contrast. If the pixel has any other value (either 0, 1, or 2) then that pixel will be displayed at its value. In this way, either the contrast level for the main display pixel or the background display pixel is assigned for that pixel. The process is repeated for all pixels in the display screen to form a composite display.

Once the combination function has been applied to the pixels, the combined composite display is displayed on the LCD screen 52. The combined display is a composition of the main display and the background, and since the background display has a lower contrast level than the main display, the main display will appear to the user to be on top of the background.

In a preferred embodiment, the process shown in figure 3 is carried out by the combiner 8 shown in figure 1.

Referring to figure 4, a display 60 on a screen is shown with data regarding the signal strength 62, local time 64, date 66, network connection 68 and remaining battery life indicator 70 displayed on the screen. A wallpaper background 72 is applied to the screen by display combiner at transfer step 74.

Furthermore, the background display can be updated at a rate fast enough to allow apparent movement or animation of the wallpaper or background. The background display can be driven by components integrated in the mobile phone, such as the clock or battery life control circuits. Information from such components can be compiled to form a suitable image that can be displayed as the background.

Referring to figure 5, an analogue clock face 80 can be displayed as background to the main display on the screen. The position of each hand of the clock can be updated every second.

Mobile telephones have thermistors or other thermometers built in to detect changes in temperature in various temperature sensitive components of the telephone. For example, a thermistor is required to measure the ambient temperature of the display screen and is used to drive a control circuit that maintains the optimum display output; the output of an LCD screen is temperature sensitive. Likewise, thermistors in the battery and rf circuits are required to control the components to operate at an acceptable performance level.

Data from the combination of thermistors may be used to display the ambient temperature as a background to the main display. In the preferred embodiment, an average of the phone thermistor outputs can be calculated and the average temperature reading displayed in an appropriate format as a background to the main display. As the temperature changes the background display is updated to display the change.

Images for display as background may be downloaded from the Internet or sent to the mobile telephone as email attachments using wireless application protocol (WAP). The format of the downloaded image can be in a readable format and stored in the background display memory store.

The main display information will also change as conditions change, such as the remaining battery life or signal strength. Whenever a condition changes the portion of the display that is to be changed can be updated, combined

with the background and redisplayed. In this way only portions of the display that change are updated thus reducing the amount of data being processed by the display compiler.

- 5 Further designs of wallpaper or background will be apparent to the skill person. For example, the name of the person calling can be scrolled across the display or a graphic can be shown to indicate a message in the voice mail facility. Other types of display may become apparent as the
10 technology advances and an embodiment of the present invention could be used to display background information on such displays.

CLAIMS

1. A mobile telephone display unit for displaying information to a user, comprising; a first memory store for storing a main image; a second memory store for storing a background image; a combiner for combining the main image with the background image thereby forming a composite image; and a display for displaying the composite image.
2. A mobile telephone display unit as claimed in claim 1, wherein the combiner comprises an OR gate.
3. A mobile telephone display unit as claimed in claim 2, the combiner further comprising; a background display driver for controlling a contrast level of the background image; and a main display driver for controlling a contrast level of the main image.
4. A mobile telephone display unit according to any of claims 1, 2 or 3, wherein the background display driver and main display driver are arranged such that the background image has a lower contrast than the main image.
5. A mobile telephone display unit according to any preceding claim, wherein the main image and background image comprise a plurality of pixels, the first and second memory stores being arranged to store pixels of the main image having a greater bit depth than the background image.
6. A mobile telephone display unit as claimed in any preceding claim, wherein the background pixels have a grey scale of 3 bits and the foreground has a grey scale of 4 bits.

7. A mobile telephone display unit as claimed in any preceding claim, wherein the display is a liquid crystal display.
- 5 8. A mobile telephone display unit as claimed in any preceding claim, wherein the first and second memory stores form part of the same memory.
9. A mobile telephone display unit as claimed in any preceding claim, wherein the first and second memory stores are separate memory units.
- 10 10. A mobile telephone comprising a mobile telephone display unit as claimed in any preceding claim.
11. A method for displaying a background image on a mobile telephone display screen, the method comprising;
15 compiling a main display with a contrast level;
compiling a background display with a different contrast level;
combining the main display and the background display thereby forming a composite display.
12. A method as claimed in claim 11, wherein the main
20 display contrast level is greater than the background display contrast level.
13. A method as claimed in claims 11 or 12, wherein the
25 mobile phone display screen comprises a grid of a plurality of pixels, each pixel having means to display at least three contrast levels; each of the main and background displays being formed of a bitmap corresponding to the display screen pixels.

14. A method according to any of claims 11 to 13, wherein combining the main display with the background display is performed using an OR function.
- 5 15. A method as claimed in any of claims 11 to 14, wherein the main display contrast level is the maximum contrast level.
16. A method as claimed in any of claims 11 to 15, further comprising driving the background display from a component integral with the mobile phone.
- 10 17. A method as claimed in any of claims 11 to 16, further comprising updating the background display after a predetermined period, and combining the updated background display with the main display thereby forming an updated composite display.
- 15 18. A method as claimed in claim 17, further comprising recompiling the portions of the main display and background display that have changed after the predetermined period.
- 20 19. A mobile telephone display unit as substantially described herein with reference to the figures
20. A method as substantially described herein with reference to the figures.
21. A mobile telephone as substantially described herein with reference to the figures.

Amendments to the claims have been filed as follows

CLAIMS:

1. A mobile telephone display unit for displaying information to a user, comprising; a first memory store for storing a main image; a second memory store for storing a background image; a combiner for combining the main image with the background image thereby forming a composite image; and a display for displaying the composite image, wherein the background image is updated after a predetermined period and the updated background image is combined with the main image.
2. A mobile telephone display unit as claimed in claim 1, wherein the combiner comprises an OR gate.
3. A mobile telephone display unit as claimed in claim 2, the combiner further comprising; a background display driver for controlling a contrast level of the background image; and a main display driver for controlling a contrast level of the main image.
4. A mobile telephone display unit according to any of claims 1, 2 or 3, wherein the background display driver and main display driver are arranged such that the background image has a lower contrast than the main image.
5. A mobile telephone display unit according to any preceding claim, wherein the main image and background image comprise a plurality of pixels, the first and second memory stores being arranged to store pixels of the main image having a greater bit depth than the background image.

6. A mobile telephone display unit as claimed in any preceding claim, wherein the background pixels have a grey scale of 3 bits and the foreground has a grey scale of 4 bits.
- 5 7. A mobile telephone display unit as claimed in any preceding claim, wherein the display is a liquid crystal display.
8. A mobile telephone display unit as claimed in any preceding claim, wherein the first and second memory
10 stores form part of the same memory.
9. A mobile telephone display unit as claimed in any preceding claim, wherein the first and second memory stores are separate memory units.
10. A mobile telephone comprising a mobile telephone
15 display unit as claimed in any preceding claim.
11. A method for displaying a background image on a mobile telephone display screen, the method comprising;
compiling a main display with a contrast level;
20 compiling a background display with a different contrast level;
combining the main display and the background display thereby forming a composite display; and
updating the background display after a predetermined
25 period, and combining the updated display with the main display thereby forming an updated composite display.
12. A method as claimed in claim 11, wherein the main display contrast level is greater than the background
30 display contrast level.

- 5 13. A method as claimed in claims 11 or 12, wherein the mobile phone display screen comprises a grid of a plurality of pixels, each pixel having means to display at least three contrast levels; each of the main and background displays being formed of a bitmap corresponding to the display screen pixels.
14. A method according to any of claims 11 to 13, wherein combining the main display with the background display is performed using an OR function.
- 10 15. A method as claimed in any of claims 11 to 14, wherein the main display contrast level is the maximum contrast level.
- 15 16. A method as claimed in any of claims 11 to 15, further comprising driving the background display from a component integral with the mobile phone.
17. A method as claimed in claim 16, further comprising recompiling the portions of the main display and background display that have changed after the predetermined period.
- 20 18. A mobile telephone display unit as substantially described herein with reference to the figures
19. A method as substantially described herein with reference to the figures.
- 25 20. A mobile telephone as substantially described herein with reference to the figures.



INVESTOR IN PEOPLE

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Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): H4T (TBLA, TBLM, TBLX)

Int Cl (Ed.7):

Other: Online: WPI; JAPIO; EPODOC; INPSEC; XPESP

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X,Y	WO99/61984 A1 (3COM) See Pages 1, 22, 47 especially	X:1,2,5,7,10 Y:8,9
Y	Microsoft Windows (RTM)	8,9

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

